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Did the NAE Changing the Conversation Campaign Introduce the Care Penalty into Engineering?

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Did the NAE 'Changing the Conversation' Campaign Introduce the 'Care Penalty' into Engineering?

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Abstract

Over the past twenty years, the National Academy of Engineering of the United States of America undertook a campaign entitled, "Changing the Conversation." Explicit intentions of the campaign included raising public awareness of engineering, increasing the total number of engineers, and recruiting historically underrepresented groups to join engineering. In particular, marketing efforts developed inclusive "tag lines" aimed to diversify groups enrolled in engineering and increase the diversity of the professional engineering workforce. While changes in demographics were disappointing for some groups (i.e., little to no change was observed for people of color), generally, the campaign has been considered moderately successful for increasing the number of females joining engineering. This is speculated to be associated with the use of tag lines that helped to "humanize engineering" (i.e., emphasizing the "people helping" aspects of engineering rather than the "building things" aspects of engineering).

The use of marketing identified to attract more females to engineering may have inadvertently introduced the "care penalty" into engineering. The care penalty refers to the lack of financial compensation for work performed by those who choose employment in a "caring profession", which is independent of the sex, gender, or gender expression of the employee. For example, "caring nurses" receive the same pay as "uncaring nurses" in a hospital setting, yet patients who have caring nurses report higher levels of satisfaction with the hospital. Unpriced benefits (i.e., "caring"), which are poorly rewarded in employee pay, represent an example of the care penalty.

It has been observed that caring professions often include a larger proportion of female employees (i.e., skilled nurses, elementary school educators, and social workers). Therefore, the use of tag lines specifically selected to attract a larger number of females to joining engineering (i.e., tag lines emphasizing the "caring nature of engineering"), may attract both more females (independent of compensation) as well as more individuals who are willing to accept lower financial compensation (i.e., individuals willing to accept the care penalty). Using a literature review, the presence of a care penalty in engineering is described, and an argument is advanced that the "Changing the Conversation" campaign may have been a contributing factor.

In conclusion, it is important to raise awareness of the care penalty and to identify ways to financially compensate workers who provide substantial unpriced services such as "caring on the job". The future of engineering includes STEMpathy, which is the explicit integration of science, technology, engineering, and math with empathy (i.e., human-centered design, community-engaged design, etc.). Therefore, the "solution" to the care penalty is not the exclusion of caring from engineering. Rather the solution must include

the innovation of properly pricing and incorporating "caring" as a "quality factor" of engineering work. This solution should include compensation with an appropriate financial wage (or alternative employment benefit for caring service provided).

Background

From before 2002 through after 2013, the National Academy of Engineering (NAE) of the United States of American undertook an intentional effort to "rebrand" the engineering profession [1, 2, 3]. The result, the "Changing the Conversation Campaign", was intended to raise public awareness of engineering, to increase the total number of engineers, and to recruit historically underrepresented groups to pursue careers in engineering, including an explicit emphasis to increase the number of females pursuing engineering. Tag lines developed through market research for the campaign included: "engineers make a world of difference"; "engineers are creative problem solvers"; "engineers help shape the future"; and "engineering is essential to our health, happiness, and safety".

In the decade following the campaign, the number of baccalaureate degrees awarded in engineering and computer science approximately doubled from a total of 74,387 in 2009 [4] to a total of 144,818 in 2019 [5]. This increase in baccalaureate degrees suggests that the campaign was effective in its goal of increasing the total number of individuals graduating in engineering and computer science (although it is important to note that correlation is not causation). Furthermore, for the purposes of this current article, it is important to note that advanced degrees (i.e., Master's and PhD are not included in the current study).

A more granular analysis of the demographic data reported by the American Society for Engineering Education (ASEE) suggests that the apparent "success" of the campaign may be limited primarily to growth in the diversity of sex within undergraduate enrollment. For example, the percentage of baccalaureate degrees awarded to female students in the "the big three" of electrical engineering, mechanical engineering, and civil engineering increased from 2009 through 2019 (i.e., from 11.5% to 14.4% in mechanical engineering; from 11.4 to 15.7 in mechanical; and from 20.1 to 25.4 in civil). In contrast, the percentage of baccalaureate degrees awarded to other historically underrepresented groups, such as black, indigenous, and people of color (BIPOC), remained relatively constant over the same period. While this result is disappointing for some groups (i.e., little to no change observed for people of color), generally, the campaign has been considered moderately successful for increasing the number of females joining engineering.

The success of the campaign is speculated to be associated with the use of tag lines that helped to "humanize engineering". Previously, I have shared my personal experience using caring theories of nursing to improve my teaching of environmental engineering practice [6]. And I have suggested that approaches from the profession of nursing, such as the National Academy of Medicine's "Getting Nurses on Boards Coalition", may

represent an opportunity to achieve some portions of the goals of the Changing the Conversation Campaign (i.e., promoting historically underrepresented groups in engineering to take on leadership roles) [7].

In this current paper, I raise the possibility that the messaging used by the Changing the Conversation Campaign and the improvement in demographic diversity to include a larger fraction of females earning degrees may point to the introduction of what is known as the "care penalty" into the profession of engineering. If true, this result could have long term implications for future efforts to enhance diversity in engineering, it could have long term implications to the societal benefits of caring engineering practice (i.e., human-centered design and community-engaged design), and it could have long term implications for disparity in the wages observed within the engineering workforce.

Care Penalty

Labor economist often explain differences in wages as "human capital", or the differences in education, experience, and other measures of skills of workers (i.e., those with more or specialized education, those with greater experience, or those with enhances skills may demand higher wages as compared to less educated, less experienced, or less skilled workers). In addition to human capital, other factors influence differences in wages, including sex; with females often earning less than males employed in similar jobs. In fact, females may earn less despite greater experience and higher levels of education. This sex bias, with females earning less than males, can be attributed to historic and ongoing discrimination (which, although critically important, is beyond the scope of this current article).

Sex may also impact wages in another more subtle manner via the "care penalty" [8]. Females tend to disproportionately concentrate in jobs in health, education, and social services where there is a professional obligation to show concern for human welfare. Two factors tend to contribute to reducing wages among those who show concern for human welfare as part of their jobs. First, the intrinsic motivation to help others can reduce the "reservation wage" and lower the bargaining power of workers (i.e., employers will offer lower starting salaries to workers who select jobs for reasons that include "satisfaction beyond the paycheck"). Second, firms that market care have difficulty capturing "positive spillovers" in terms of financial gains (i.e., firms that employ nurses, teachers, and social workers charge the same rate for "exceptional caring" or "mediocre caring" and improvements in quality are difficult to "sell" to consumers). Thus, jobs that specifically target concern for human welfare may suffer from a care penalty, which is independent of the sex, gender, or gender expression of the employee.

The tag lines developed by the NAE – "engineers make a world of difference"; "engineers are creative problem solvers"; "engineers help shape the future"; and "engineering is essential to our health, happiness, and safety" – are related to "caring". The concurrent growth in the percentage of women earning baccalaureate degrees in engineering and computer science during the intentional campaign of the NAE raises the

question, “did the NAE Changing the Conversation Campaign introduce the care penalty into engineering?” (For clarity, the goal in asking this question is NOT to disparage nor to dissuade efforts to increase diversity, equity, and inclusion within engineering; rather, the goal is to raise awareness to the importance of evaluating the nuance that may be present in marketing efforts and the unintended consequences of campaigning.)

Supporting Data

Recent analysis of the engineering labor market may suggest that the answer to this question could be “yes”.

For example, among the “big three” disciplines, median salaries for electrical engineers were $95,780 in 2014; for mechanical engineers median salaries were $87,140; and for civil engineers the 2014 median salary was $87,130. Thus, the engineering sub-discipline with the smallest percentage of female graduates (electrical) earned the highest median salary, while the engineering sub-discipline with the highest percentage of female graduates (civil) earned the lowest median salary [9].

While the analysis by Kuehn and Salzman [9] provided a correlation among salaries and sex, our recent work explored this question with greater granularity [10]. First, we reported a thematic analysis of the language used in environmental engineering as compared to the language common in professions that are believed to suffer from a care penalty (i.e., nursing). Second, we examined salary data controlling from confounding factors. And third, we specifically looked for the presence of a “care penalty” independent of sex (i.e., we deconflated salaries for sex, and explored the correlation of salary among engineering sub-disciplines both for male and for female). A detailed analysis of the engineering labor market is beyond the scope of this article, and the reader is encouraged to consider the data and analysis presented previously [10].

Discussion

The future of engineering in the United States has been described to be closely connected to the future of STEMpathy, where human empathy becomes an essential skill of professionals working in science, technology, engineering, and math (i.e., [11]). One reason offered for the importance of STEMpathy relates to the ability of technology to “flatten” the world (i.e., while the mathematics of engineering design and the physical aspects of construction may be outsourced around the world, it is unlikely that the human interactions important for design will be outsourced). A recent example of STEMpathy is the approach to community engaged design used to create COAST – the Caribbean Ocean and Aquaculture Sustainability faciliTy [12, 13]. COAST is the first application of parametric insurance to protect the food security and livelihoods of artisanal and small-scale fisherfolks and their families, and the creation of COAST benefitted from direct interaction between the community stakeholders and the engineer in charge [14].

In fact, the integration of "caring" into technical professions within STEM offers the possibility of employing "convergence" to solve "wicked problems" through the emergence of "V-shaped" professionals [15]. Convergence research is defined by two characteristics, namely: 1) deep integration across disciplines (i.e., moving from interdisciplinary to transdisciplinary); and 2) solving a specific and compelling problem (i.e., sustainable development). V-shaped professionals are those who work in parallel disciplines in the present with a shared view of a common future (i.e., akin to the "vanishing point" used in two-dimensional artwork for the purposes of providing the illusion of a third dimension). For example, the integration of "humanitarianism" plus "technologist" to create the emerging profession of "humanitarian technologist" is an example of a prototype profession at the interface of empathy and STEM who uses current technology to create a better future world [16]. Similarly, the integration of nursing with engineering to create the profession of the "nurse+engineer" – who works from the bedside to the community to improve healthcare and promote wellness among individuals, families, communities, and nations – is an example of a V-shaped profession with modern parallel disciplines (i.e., nursing and engineering) sharing a common goal (i.e., affordable healthcare for all) [17].

Limitations

As noted above, raising the question of the care penalty being introduced as part of the "Changing the Conversation Campaign" is neither intended to disparage nor to dissuade efforts to increase diversity, equity, and inclusion within engineering. It is important that careful intellectual criticism be considered as a way of improving efforts, without being used as justification to cancel efforts. Similarly, while a focus on financial benefits is important, the reader is cautioned to avoid reducing professions to financial salaries. Instead, "triple bottom line" accounting that considers the "prosperity" as well as the "people" and "planet" is an essential component of healthy intellectual debate. In particular, when considering the "wicked problem" of sustainable development, engineers must avoid the lure to frame problems and solutions through an exclusive lens of the "human benefit" and must also consider benefits to the planet by de-centering humans in the discussion of sustainable development [18].

Conclusion

In conclusion, raising awareness of the care penalty among engineers is important. Also, it is important for employers of engineers to identify ways to financially compensate workers who provide substantial unpriced benefits such as "caring service". As STEMpathy will play an important role in the future of engineering, it is important that engineering leaders consider the potential impacts of the care penalty and look for ways to leverage caring as a benefit to be captured and incorporated into the "quality" of engineering work.

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